

EXECUTIVE SECRETARIAT

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Executive Secretary
4 Dec 84

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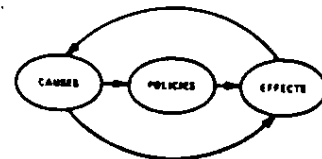
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POLICY STUDIES ORGANIZATION

to promote the application of political and social science to important policy problems

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Executive Registry

84-9843

TO: People Engaged in Policy Analysis, Program Evaluation, and Related Activities in the Federal Government.

FROM: Stuart Nagel on behalf of the Policy Studies Organization

DATE: November 7, 1984

SUBJECT: Policy/Goal Percentaging Analysis: A Decision-Aiding Program

Enclosed is a description of a decision-aiding program which the Policy Studies Organization is making available for research and development purposes to policy analysts, program evaluators, and other important decision-makers in the federal government.

The program is designed to process a set of (1) goals to be achieved, (2) alternatives for achieving them, and (3) relations between goals and alternatives for choosing the best alternative or combination for maximizing benefits minus costs. Interest has already been expressed in the program by people in such federal agencies as Agriculture, Air Force, Army, Defense, Education, Energy, Housing/Urban Development, Interior, and Transportation.

The program can perform a variety of useful decision-making analyses such as (1) choosing, ranking, or allocating to alternative categories, (2) working with goals that have a common measurement unit or that are multidimensional, (3) doing what-if variations on the goals, alternatives, and relations, (4) doing a threshold or convergence analysis to indicate the scores on the goals, alternatives or relations that will make a difference in the winning alternative or how resources are allocated, (5) adjusting results for minimums, maximums, and other constraints, and (6) comparing optimum choices with actual choices in order to reduce the gap between the actual and the optimum.

If you would like to try the program, please inform me, and I shall be pleased to send you a free copy along with the preliminary manual for using it. All we ask in return for now is that you tell me about your experiences so we can use those experiences to improve the program for general use and for more specific uses relevant to the government agencies in which you are interested.

I look forward to the possibility of receiving a favorable reaction from you or from whomever you consider to be appropriate people within your government agency. I am especially interested in discussing how the program can be varied to fit the specific needs of different units within your department. Thank you for your help on this matter. Best wishes for our shared interest in improving the effectiveness and efficiency of government decision-making.

SSN:bs

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2304

P/G% ANALYSIS: A DECISION-AIDING PROGRAM

Stuart S. Nagel, University of Illinois

October 1, 1984, Draft

This short article briefly describes a new microcomputer program called Policy/Goal Percentaging Analysis. The program is designed to process a set of (1) goals to be achieved, (2) alternatives for achieving the goals, and (3) relations between goals and alternatives in order to choose the best alternative or combination for maximizing benefits minus costs.

The program is called Policy/Goal Percentaging Analysis because it relates alternative policies to goals, and it makes use of part/whole percentages in order to handle the problem of goals being measured on different dimensions. The measurement units are converted into a system of percentages showing relative achievement of each policy on each goal, rather than a system of inches, dollars, apples, days, or other measurement scores. The abbreviated name of the program is P/G%.

The decision-aiding system involves basically the following steps:

1. Listing the alternatives from which a choice needs to be made, or to which an allocation needs to be made.
2. Listing the criteria or goals which one wants to achieve and their relative importance.
3. Scoring each alternative on each criterion with as precise or as rough a relation score as is available.
4. Converting the scores into part/whole percentages or other scores that can show the relative relations of the alternatives on each criterion.
5. Aggregating the relative scores for each alternative across the criteria in order to arrive at an overall score or allocation coefficient for each alternative.
6. Drawing a conclusion as to which alternative or combination is best, or how much of a budget or a set of scarce resources should be allocated to each alternative.
7. Changing the alternatives, criteria, relations, and other inputs to see how such changes affect the conclusion.

To facilitate applications of part/whole percentaging, an appropriate microcomputer

program has been developed. It can be applied to any problem involving one or more policies and one or more goals. The program is especially useful when one is working with many policies, many goals, various measurement units, and other constraints and conditions. The program can run on an IBM PC or an IBM-compatible microcomputer.

The computer program is divided into five parts covering the following:

1. Accessing, creating, or deleting a datafile of information relevant to resolving a decision problem.
2. Inserting or changing the inputs regarding the alternatives, goals, relations, or amount of scarce resources to be allocated.
3. The initial results based on the alternatives, goals, and relations.
4. The post facto analyses, which include threshold analysis and convergence analysis.
5. A provision for saving and storing data files that one might want to refer to in the future.

The post facto analyses are especially useful to aid in resolving disputes as to what the weights or relation-scores should be. Threshold analysis is one option, whereby the computer shows what it would take in changing the goals-weights or the relation scores to bring the second place alternative up to first place or any alternative up to any other alternative. For example, if there is a dispute as to whether a relation-score is a 2 or an 8, and the threshold value is a 10, then there should be no need to dispute the matter further since neither a 2 nor an 8 will make any difference in terms of the second place alternative moving to first place. Convergence analysis is another option whereby the computer shows at what level the weight for a goal becomes high enough to produce results that are quite close to the results that would occur if that goal were the only goal. For example, if there is a dispute as to whether a goal weight is a 5 or a 10 and the convergence value is a 3, then there should be no need to dispute that matter further.

The P/C% approach differs from other decision-aiding approaches by virtue of being able to deal meaningfully with all of the following decision-making situations:

- (1) multi-dimensional goals, (2) choosing the one best alternative, (3) choosing the best

combination of alternatives, (4) making choices where risks and probabilities are involved, (5) making choices where doing too much or too little is undesirable, (6) allocating scarce resources, even where there are millions of alternative ways of allocating a given budget to a set of budget categories, (7) situations with multiple missing information, (8) situations involving public policy, law, business, medicine, or personal decision-making, (9) situations where all the goals are measured on the same dimension, (10) situations involving prediction as well as prescription, and (11) minimums or maximums on the alternatives, goals, or other constraints.

The approach also differs from other approaches by virtue of having the following characteristics:

1. P/G% can easily go from alternatives, goals, and relations to drawing a conclusion.
2. It has been translated into a highly user-friendly microcomputer program.
3. It is based on mathematical justifications that relate to classical calculus optimization, especially if one views the part/whole percentages as proxies for non-linear regression coefficients.
4. It comes with lots of illustrative applications and years of relevant experience.
5. It is analogous to mathematical programming procedures such as linear, non-linear, integer, goal, and multi-objective programming, but without the complexity and unrealistic assumptions.
6. The program can systematically compare optimum choices or allocations with actual choices or allocations in order to bring the optimum closer to the actual and vice versa.

A limitation which the program currently has is the requirement that one have access to an IBM-compatible microcomputer with 192K of memory and a graphics adapter. The program is, however, being developed for running on other microcomputers. A body of experience is also being developed which will be incorporated into a booklength manual consisting mainly of various applications entitled Better Decision-Making: Relating Options to Goals. Those applications are also leading to further improvements in the versatility of the program. The program is mainly limited by the fact that the real

world involves multi-dimensional goals, missing information, complex constraints, and other problems, but the program seeks to handle those problems as well as can be done.

For further information concerning this multi-criteria decision-aiding tool, write or phone Stuart S. Nagel, 361 Lincoln Hall, University of Illinois, Urbana, Illinois 61801, (217) 359-8541. The microcomputer program is based on S. Nagel, "Multiple Goals and Multiple Policies." Chapter 16 in *Public Policy: Goals, Means and Methods* (St. Martin's, 1984). A copy of the program, the present manual, and the periodic updates can be obtained for experimental purposes for only \$20 to cover the cost of a floppy disk, photocopying, postage and handling. A copy of the current manuscript for the relevant book entitled Better Decision Making: Relating Options to Goals is also available for an additional \$15.

DISPLAY 1. AN ABBREVIATED VERSION OF THE MAIN MENU OF THE P/G% PROGRAM

CHOOSE AN OPTION:

1. Enter total budget
Currently set at \$ 947.00
2. Review Alternatives
3. Review Criteria
4. Enter Alternative scores
for each Criteria
5. Perform primary analysis
6. Threshold analysis
7. Save present model